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Digitised audio signal electronic recording and playback unit - digitises, compresses and stores input from microphone to solid state memory, and plays back in analogue form to loudspeaker.

PROVERA-GES PROJEKTIERUNG &
VERMOEGENSAD 92.03.09 92DE-4207447

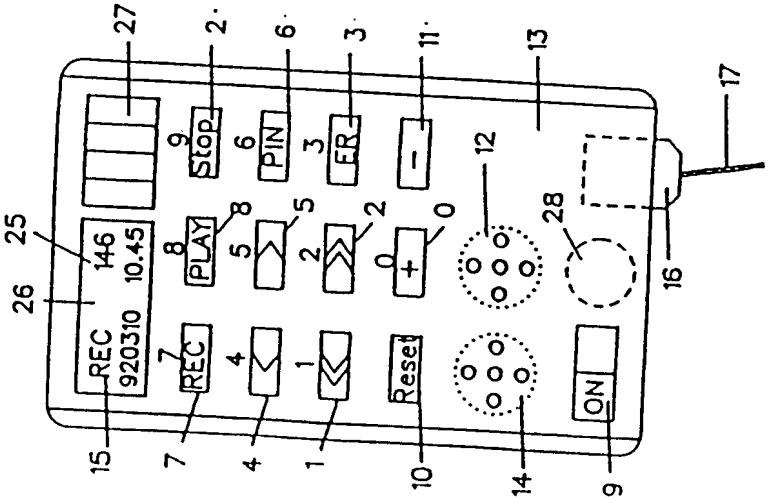
W04 (93.09.16) G10L 5/04

The miniaturised unit for the recording and playback of audio signals uses digital signal circuit techniques. The compact unit is microprocessor based and allows spoken messages to be entered via a microphone (12) that connects with an A/D converter. The generated digital signals are transmitted via an interlock circuit that requires a PIN number which is entered via a keyboard (0-9).

The digitised data is subjected to a data compression process before being entered into memory. When accessed, with the aid of the PIN number entry, the data is expanded and converted into analogue form for output by the loudspeaker (14). Speech or music may be handled.

USE/ADVANTAGE - Solid state digital signal recording. Controlled access. No moving parts, so no sensitivity to vibrations. More compact unit, and easier access to desired part of stored information. (9pp Dwg.No.2/7)

N93-228029



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DE 37 04 814 A1
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DE 88 10 350 U1

(54) Verfahren und Gerät zur digitalen Aufzeichnung und Wiedergabe von Informationen

(57) Um die Nachteile einer analogen Sprachaufzeichnung zu vermeiden, wird eine Erfindung beschrieben, akustische Informationen über Analog/Digital-Wandler digital aufzuzeichnen und beim Abrufen wieder die digitalen Aufzeichnungen über einen Digital/Analog-Wandler einem akustischen Ausgabesystem zuzuführen.
Die weitere Ausgestaltung besteht darin, mittels Festspeicher die Betriebssicherheit und Baugröße eines solchen Gerätes zu verbessern.

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Die folgenden Angaben sind den vom Anmelder eingereichten Unterlagen entnommen

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Fig.1

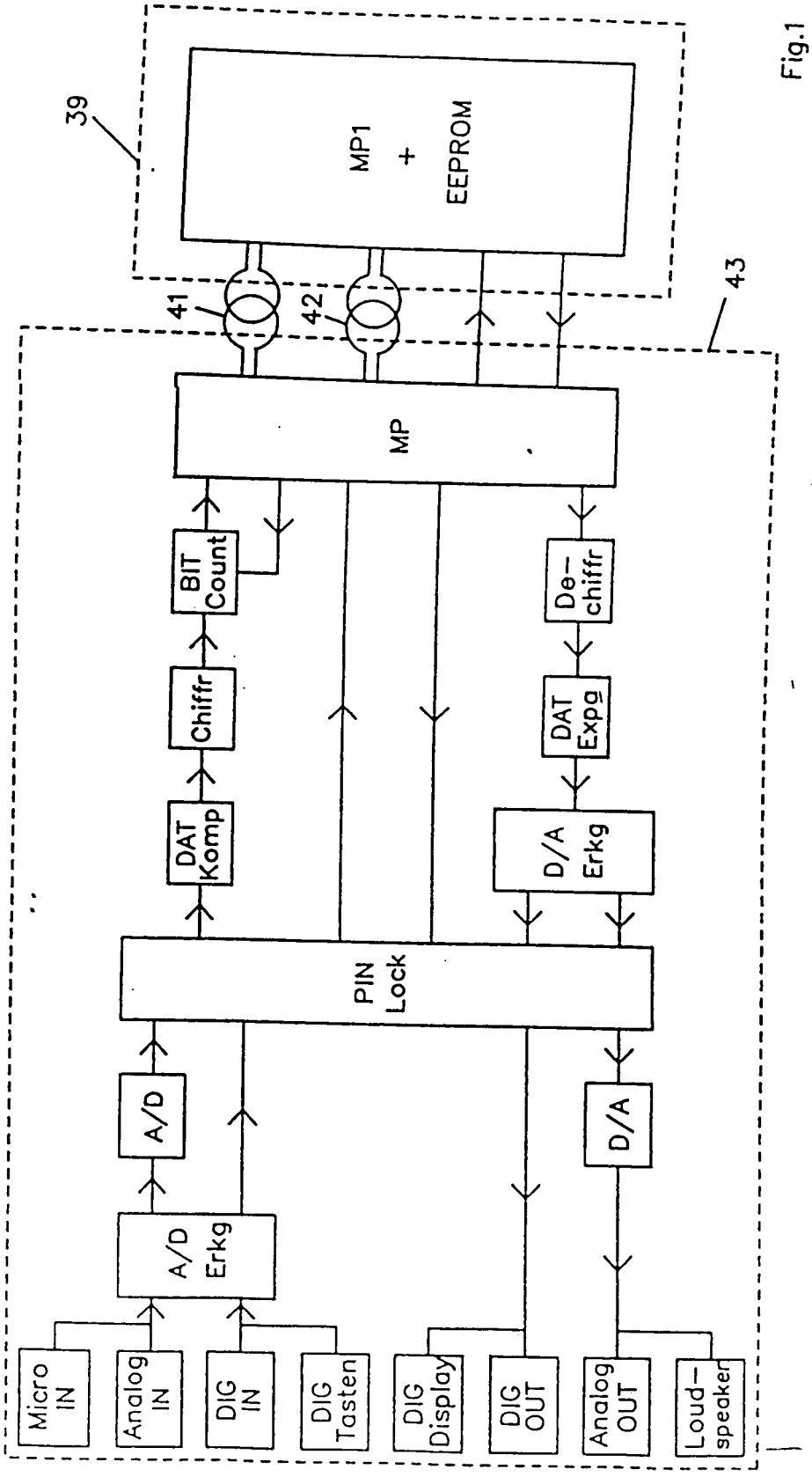

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Fig.2

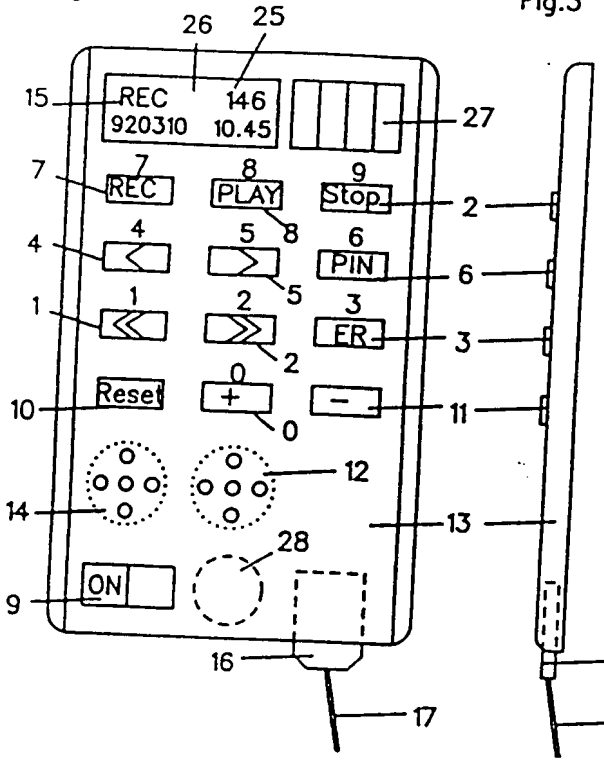


Fig.3

Fig.4

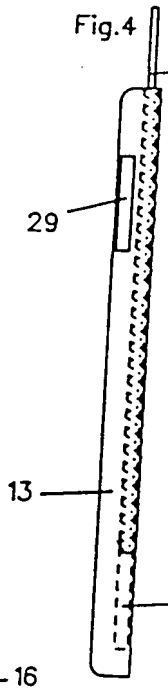
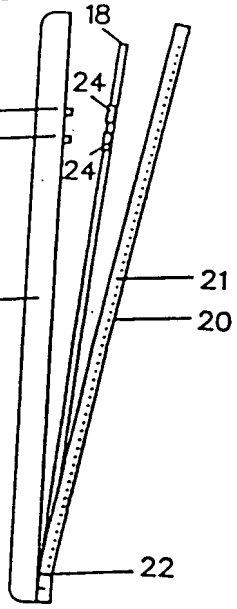


Fig.5



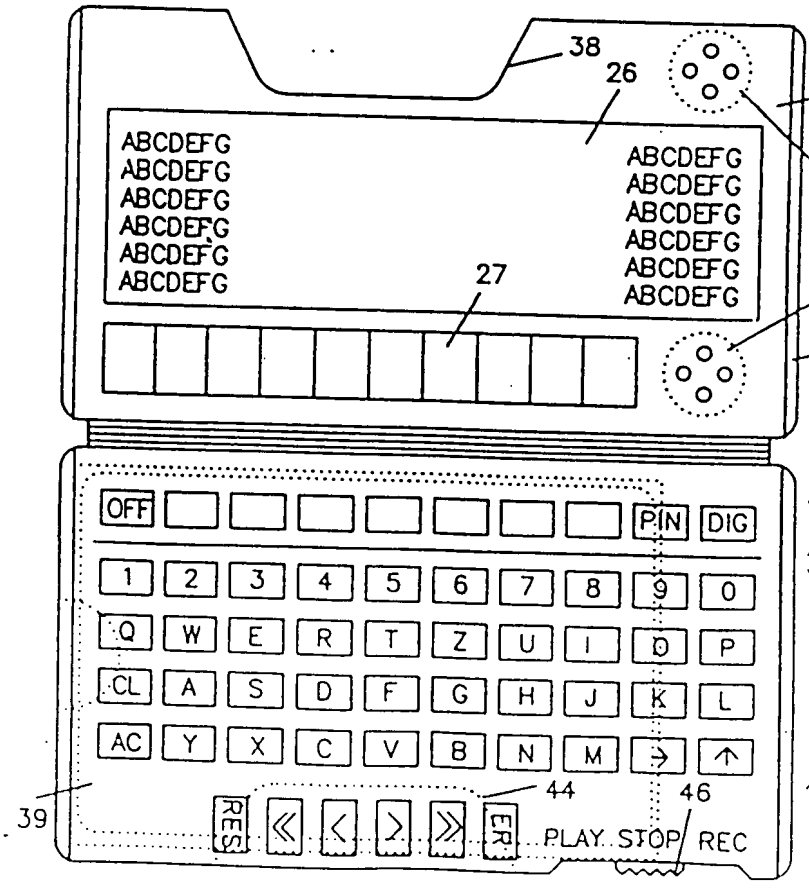
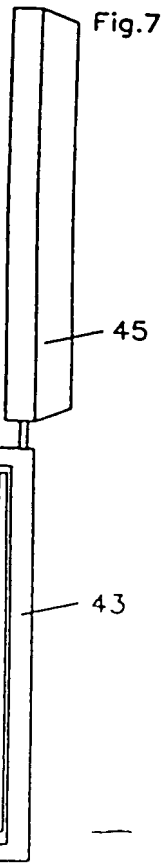


Fig.6

Fig.7



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PROCEDURE AND DEVICE TO DIGITALLY RECORD AND PLAY BACK INFORMATION

[Verfahren und Gerät zur digitalen Aufzeichnung und Wiedergabe von Informationen]

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(54) PROCEDURE AND DEVICE TO DIGITALLY RECORD AND PLAY BACK INFORMATION

Description

/1*

It has been common and widespread for years to record texts by entering them via typewriter-like keyboards into electronic memories. Given the wide distribution of personal computers, the devices also have the advantage that they can be connected via an interface so that records made while traveling can be transferred directly to the computer at home or in the office.

Contrastingly in the area voice recording, there has not been any successful storage on non-moving information carriers. Dictation devices usually use as the sound carrier tape cassettes that have been highly miniaturized but which must be driven mechanically.

With reference to modern technologies proven in other areas, the problem of the invention is to describe a procedure and the concepts of a device which are suitable to digitally record and play back information.

The advantages are obvious: no moving parts and hence no sensitivity to vibration, substantially smaller dimensions, and more comfortable access to any part of the stored information.

By combining and using the most recent technologies, such a device according to the invention can be constructed that not only has a very large capacity, but is also extremely small and inexpensive.

From the beginning, it was not just important to provide a device for digitally storing entered information (e.g. via alphanumeric keyboards or the output interface of a PC, scanner or other digital

*Numbers in margin correspond to pagination in foreign text.

information) but also to arrange an acoustic analog input with a digital/analog converter (D/A converter) for general use.

It is therefore suggested in the invention that an A/D converter be provided in such a device after the analog signal input that digitally conveys the data programmed by a microprocessor (MP) to the memory of the information carrier, and a D/A converter emits the digital values as analog signals to the output system to output the stored information. According to the invention, a direct output of digitally stored values to a digitally-operating output system, e.g. an LC display, is also provided. Basic measures are described that allow the recording device to be easily and reliably operated, and operation is particularly successful when the measures are combined.

First, it is suggested according to the invention that a bit counter be provided in the device that counts the already "used" bits, "numbers" them, and, upon an interruption, stores the respective active (i.e., addressed) bit or its number, and displays it exactly or nearly exactly in a reproducible manner on a display or with an LED.

The function of the bit counter corresponds to that of a counter of a tape cassette and allows information to be sought and found.

The bit counter has a second task. If e.g. someone wants to interrupt a dictation, a standby program is started by the MP that interrupts the recording process and stores the corresponding bit number. The device is in a waiting or standby state, and recording can start at the stored bit number when the dictation is continued.

Since the use of relatively expensive storage capacity of volatile memories such as EEPROMs is limited by economic considerations, the

invention recommends providing an automatic pause circuit in the MP that interrupts at a slight delay (i.e., after 1 sec.), recording onto the memory when there are no input signals, and only restarts when input signals arrive. Since electronic storage starts immediately, no information is lost with this pause circuit as is the case with tape cassettes where the tape drive must be started.

To save storage capacity, it is also suggested according to the invention to provide a system for compressing data before storing it and to use a data expansion system when outputing the data. There already exist numerous procedures for constructing such circuits, and the system that appears to be most suitable can be selected for use in the invention.

The misuse of data is a feared problem, and the invention hence provides for the prevention of unapproved access to the processed data by a personal identification number (PIN). Such a circuit, for which there are also numerous suggested solutions, can (in the easiest case) consist of a 4-6 bit number that is only known to the owner of the device and which must be entered before turning on the device.

To fully exploit the great advantages of electronic memories, the invention provides a corresponding layout of the operating elements. Among other things, it is accordingly suggested that a "listen" key be provided that starts a "listen" subprogram which interrupts the recording of the information, stores the status of the bit counter, resets the bit counter by a specific number of bits, and edits from this point of the dictation or recording up to the bit number at which the interruption was started. This key can then be reactuated and the

message can be reheard, or recording can continue by actuating the "record" key or by entering another command.

If one wants to hear a large section of the dictation, it is suggested according to the invention that a "rewind" key be provided that has a similar function to the "listen" key but which rewinds the bit counter by a larger number of bits so that a larger section of information is output. When this key is actuated several times, the bit counter rewinds a corresponding number of bits.

To quickly go back to the beginning of the recording, it is also recommended that a "reset" key be provided that returns the bit counter to the beginning of the recording.

This makes it possible to enter an identifier at the beginning of a new dictation with a "marking" key, so that when the reset key is actuated, the bit counter does not return to 0 but to the prior "start" marking signal. If several messages are stored, the beginning of each message can be marked and directly requested.

When memories are used that are nonvolatile when not energized, i.e., their stored information is retained (such as EEPROM memories), the device can be designed to be more flexible and easier to use by separating the information carrier in the form a card from the device without requiring a battery to retain the data.

Such information carriers according to the invention can have the shape and dimensions of chip cards already widely used as telephone cards. Such cards are already mass produced so that such information storage devices can be manufactured at extremely low prices.

At the moment, such chip cards are connected to the input and

output device via gold-plated contacts to attain sufficient quality. According to the invention, however, it is suggested that a contactless design be provided, as will be primarily used in the future. At least the data transmission between the device and the information carrier should be contactless, i.e., with inductive, capacitive, or optoelectronic means. This would be easy if the device and the card were tightly coupled together.

With a correspondingly compatible device design, even telephone chip cards can be used as information carriers under certain prerequisites.

This can be easily done by placing a microprocessor in the card in addition to the memory that processes the access to the stored date, as is already common in telephone chip cards. In the MP in the device, a corresponding communication program is provided to start and carry out the data transfer with the information carrier.

Since both analog and digital data can be entered according to the invention, the above combination allows a code number to be entered into information carrier microprocessor that releases access to the memory of the information carrier only after this code number is entered.

This means that there is double data security: In the first case the PIN for turning on the device, and then the code number that is stored in the card and which blocks access to the stored data when the card is removed.

With advancing miniaturization, it is recommended that the available components be used to integrate other functions such as:

- Data and clock display

- Telephone or address list
- Memos
- Paging, and others.

Fig. 1 shows the basic construction of a device according to the invention that is suitable for processing analog and digital signals.

Shown on the left side are the 4 entry possibilities:

"Analog IN" with a direct connection to an installed microphone "Micro IN,"

"Dig IN" with a direct connection to the key pad (DIG keys).

The signals pass from the inputs to a signal discriminator (A/D Erkg) that recognizes the difference between the entered data and either transfers it the analog/digital converter (A/D) or directly to the blocking circuit (PIN LOCK) that tests whether there is a PIN and whether the entry may be passed on or not. Only when a correct PIN is entered does this circuit open the data path to the next component that compresses the data (DAT Komp) to reduce the number of bits to be stored.

From there, the compressed data passes into an encoding circuit, (Chiffr) where they are encoded according to one of many familiar procedures.

In the next step, they are processed in a bit counter, (BIT Count) for the bit assignment in the memory. The bit counter receives from the microprocessor (MP) the corresponding information and commands that are necessary for faultless exchange of data between the microprocessor (MP) of the chip card (39) with its EEPROM memory.

Shown schematically in Fig. 1 is the exchange of data between the

device and the information carrier without contacts via two induction loops, where loop (41) is for data transfer in one direction and loop (42) for data transfer in the opposite direction. Lines may be provided via contacts for the power supply to the microprocessor (MP1) of the chip card (39).

This exemplary arrangement is only selected to better understand the invention. Any other method of transmission for the transfer of data and the power supply can be equally provided according to the invention.

When the data are sorted from the data memory (EEPROM) via the microprocessor (MP1), they first pass via the inductive loop (42) to the microprocessor (MP) of the device and pass in reverse sequence to a decoding circuit (Dechiffr) and are then supplied to a data expansion (DAT Expa) circuit to yield a complete digital representation of the information.

In order to recognize whether the information in the output data is digital or analog, the data are checked in a recognition circuit (D/A Erkg), and when the PIN lock is open and the data is digital, are supplied directly to the digital output or the display (DIG Display).

If the information is digitalized analog data, they are passed via a digital/analog converter (DA) and either directly reach the loudspeaker of the device or a parallel analog output (Analog OUT).

A substantially simpler exemplary embodiment is shown in Fig. 2 and 3. This device is limited to the simple acoustic recording and reproduction of voice or simple pieces of music and the digital entry of numbers such as PINs. The dimensions of such a device could be those /

of a small pocket calculator or the format of a credit card, i.e., 86 x 54 mm and 4 mm thick, which, as experience shows, is necessary to attain corresponding stability.

In this example, a keypad with only 12 keys (0-11) is shown.

To turn the device on, a switch (9) is provided that is suitably designed as a sliding switch to keep from accidentally turning it on. At the top edge of the device, there is an LC display (26) and a solar cell (27) as a power supply. In the bottom part is the microphone (12) and the loudspeaker (14). The bottom edge is provided as a possible installation site for a battery (28). In the same manner, a connection plug (16) can be at the bottom edge for a wire (17) to the computer or to other peripheral devices.

The described arrangement is a possible example. Of course, all of the parts can be in any other arrangement suitable for use or to spatially accommodate the parts.

Such a device is extremely simple to operate. After turning it on with the switch (9), the device is ready to operate, and the display shows in the top line what function is turned on. The display (15) (REC) is shown, which means that the device is switched to "recording," i.e., for storing the words spoken into the microphone (12). The display (25) indicates the respective status of the bit counter; 146 in the example.

Another example of a function is the second line of the LC display (26), which shows the date and time. March 10, 1992, 10:45 h is shown.

If one wants to protect the device from unauthorized use, a personal identification number (PIN), e.g., a 4 digit number, can be

entered. The (PIN) key is pressed, and via the numeric keys the desired secret code number is entered that is either shown on a display (26) or represented symbolically as desired. After entering e.g. a 4-digit PIN, the (PIN) key is pressed, the entered PIN is stored, the display is erased, and the device can only be operated after this PIN is entered.

The additional operation can be seen directly from the common symbols:

The REC Key (7) means record,

The PLAY key (8) means play the stored information,

The STOP key (9) means that the functions are stopped but the device is not turned off so that one can continue to work without reentering the PIN.

The "listen" key (4) rewinds the bit counter a few bits, and the stored message is replayed over the loudspeaker (14) until the interruption site is reached, characterized by the bit numbers at the interruption.

If one wishes to rewind the bit counter more to hear longer message sections, the key (4) can be pressed repeatedly, which can mean that each key press rewinds the bit counter e.g. 200 bits.

If, however, key (1) is pressed, this "fast rewind" key rewinds the bit memory e.g. 1000 bits in each case. The same holds true for forwarding by pressing the "forward" key (5) or the "fast forward key" (2), which advances the bit counter to a higher value. The MP recognized the last bit number and prevents the last information from being "run over."

The attained bit number appears as bits (25) in the display (26).

To keep the bit display (25) from changing rapidly, it can be useful to only display the power of ten or another fraction such as the fifth of the bit display. An approximate display (e.g. several LEDs) is possible according to the invention.

The (ER) key (3) (erase key) serves to erase the stored message. In the invention, the function of this key depends on simultaneously pressing e.g. the reset key (1) to avoid unintentional erasing of the stored information.

Finally, the keys (0) and (11) can lower or raise loudness.

Plug (16) with wire (17) serves to connect the device with other peripheral devices. For example, an additional microphone or an amplifier with a loudspeaker can be connected. In like manner, the device can be connected with a fixed input and playback device to scan dictations, via headphones or with a foot switch in the usual manner.

However, a data connection to a computer with all of its advantages can be created via the plug connection (16).

The listing of these possibilities does not represent a limitation; practically all procedures for data communication can be used.

Fig. 3 shows the side view of the device (13) in an exemplary embodiment. The extremely flat construction is characteristic for a device according to the invention.

Fig. 4 shows another exemplary embodiment of a device according to the invention where the information carrier in the form of a card (18) is inserted into and removed from a slot (19) in the housing (13).

This simple expansion of the device is an ideal solution to expand the storage capacity of the device to practically any extent.

The contactless transmission of data between the device and card makes handling easier. A simple slot (19) in the device housing (13) is sufficient to insert the card (18). Data and possibly power can be transmitted to the electronic components in the card (18) inductively, capacitively, or by means of optoelectronic elements such as LEDs, photodiodes, or solar cells.

With cards with contacts, Fig. 5 shows how the card (18) is used with contacts (24) on the back of the device housing (13), and a cover (20) receives the card (18) in a recess (21). The cover (20) is connected by a hinge (22) to the housing (13), and when closed, presses the contacts (24) against the elastic counter-contacts (23). /4

When the card (18) is not inserted, the cover protects the contacts (23) from dirt.

According to the invention, the device can be supplied with power, like pocket calculators, by batteries (18) and/or solar cells (27), suitably with chargeable batteries that the solar cells can charge.

Finally, it is recommended according to the invention that a changeover switch be provided on the device to switch to acoustic, i.e., analog or digital input. The switch (29) can e.g. be located on the edge of the device as shown in Fig. 4. Such a changeover switch can also be designed as an automatic switch that can sense whether the input is analog or digital and correspondingly switches as shown in Fig. 1 (A/D Erkg).

Fig. 5 is an example of a complex device with all alphanumeric entry.

This device with a swing-open display (26) and powerful solar cells

(27) is also designed for the input of digital information, e.g. via the keypad (30) or of analog information, e.g. via the microphone (12). A plug (31) also allows input of analog and digital information from peripheral devices. The plug (31) is also suitable to output data to peripheral devices and to connect an external power supply.

The data field (30) essentially has the same design of the keys of a typewriter and can take over in the usual, familiar manner all the functions of familiar computer keyboards. Above the keypad (30) is a series of function keys (31) that have an "off" key in this example, and general function keys (F1-F7) that can call up programs or individual functions as desired via the device microprocessor (MP) as subprograms.

Such a subprogram is e.g. also started by actuating the (PIN) key that requests the input of a personal identification number (PIN). A number with several digits can then be entered, which is stored in the device by pressing the (PIN) key again. This PIN prevents future unauthorized actuation of the device and unauthorized access to the data. When the device is turned on again, the secret PIN must be entered via this key.

The (DIG) (digital) key switches between storing digital or analog information. This basically means switching from a typewriter function with a memory to an acoustic dictaphone with analog input and digitally stored values.

If desired, the device can be equipped with an automatic recognition circuit that, depending on the incoming signals, recognizes whether the data input is digital or analog and automatically controls the data input via the MP of the device.

The function of the alphanumeric data keys is prior art and does not need to be explained. A shift key (33) is in the key field that switches the letters from upper case to lower case or to special characters in the usual manner.

The space key (34) inserts spaces, and the AC key (35) erases the last entered value.

The set of keys (36) is intended for the functions of recording analog signals, e.g. like a dictaphone. The set of keys (36) is arranged at the bottom edge of the device so that they can be seen, even when the lid (37) is closed, thanks to the recess (38). To the extent necessary, they remain actuatable as indicated by the dotted line (44) in Fig. 6.

For reasons of safety, the outer keys (RES) (reset) and (ER) (erase) are not located within the recess (38) to avoid the unintentional actuation of these keys that would lead to a loss of data.

Also shown in Fig. 7 is an example of how a chip card (39) can be inserted in the slot (40) to save space.

The edge (45) gripping the side not only reinforces the cover (37), but it also covers the slot (40) when closed and prevents the chip card (39) from falling out of the slot (40).

The slide switch (46) to switch from STOP to REC or PLAY is also arranged according to the invention so that it can be actuated when the cover (37) is closed.

The short schematic representation of two different designs of the inventive idea does not exhaustively represent the subject. It only serves to better illustrate the inventive idea.

The particular importance of the invention is not in the described advantages, but rather the comprehensive synergistic effect from the combination of technological and design features.

The description and drawings hence provide valuable instructions concerning the design possibilities of a device according to the invention.

Patent Claims

1. Procedure and device to digitally record and play back information, consisting of an information carrier with one or more solid state memories and an input and output system, characterized in that the information is input acoustically to an analog/digital converter (A/D converter) which supplies the data to a microprocessor (MP) which are stored on the information carrier; the data are supplied to an acoustic output system by a retrieve command either directly as digital data and/or after being converted to analog signals in a D/A converter.

2. Procedure and device according to claim 1, characterized in that digital data can be entered and stored in addition to the input of acoustic information.

3. Procedure and device according to claim 1, characterized in that a bit counter is provided that counts and stores the number of used bits up to the respective active addressed bit of the memory and displays the exact or approximate bit number in a reproducible manner on a display or by LEDs.

4. Procedure and device according to claims 1 or 2, characterized in that, in the case of an interruption, the current bit number is stored and a standby MP program is available that continues the input or /5

readout of information at the stored bit number after entering a digital or acoustic signal.

5. Procedure and device according to one or more of the prior claims, characterized in that a pause switch is programmed in the MP that interrupts the recording in the information carrier after a short delay when there are no acoustic input signals, and it continues the recording when new input signals arrive.

6. Procedure and device according to one or more of the prior claims, characterized in that a system is present in the device to compress and expand data.

7. Procedure and device according to one or more of the prior claims, characterized in that a system is present in the device to encode and decode data.

8. Procedure and device according to one or more of the prior claims, characterized by a program in the MP of the device to input and store a PIN (personal identification number) that releases access to the data memory only after a PIN is input.

9. Procedure and device according to one or more of the prior claims, characterized in that there are keys or sensors that start a "listen" subprogram via the MP that interrupts the recording of data, stores the reached bit number, and reads out the last stored data beginning at a previous bit number and blocks further recording until e.g. the recording key is pressed or another command is input that continues recording.

10. Procedure and device according to claim 9, characterized in that there is a rewind key that rewinds a multiple of the bit number via

the MP and correspondingly increases the amount rewound when the key is pressed several times.

11. Procedure and device according to one or more of the prior claims, characterized in that there is a reset key that resets the bit counter and returns the data recording to the beginning of recording.

12. Procedure and device according to one or more of the prior claims, characterized in that there is a marking key that marks the actuation via the MP in the bit counter and/or information memory which limits rewinding when the reset key is pressed.

13. Procedure and device according to one or more of the prior claims, characterized in that the information carrier is equipped with one or more memories that contain stored data when not energized.

14. Procedure and device according to claim 13, characterized in that the information carrier can be separated from the device.

15. Procedure and device according to claim 14, characterized in that the information carrier has the shape and dimensions of a chip card such as a standard telephone card.

16. Procedure and device according to one or more of the prior claims, characterized in that the information that is separable from the device contains a microprocessor in addition to the memory that processes the access to the data as with telephone cards.

17. Procedure and device according to claim 16, characterized in that MP of the device possesses the necessary programs to exchange data with telephone cards.

18. Procedure and device according to one or more of the prior claims, characterized in that a program is contained in the

microprocessor of the information carrier that makes the access to the data memories in the information carrier dependent on the input of a code number.

19. Procedure and device according to one or more of the prior claims, characterized in that the data between the device and information carrier is transmitted via contacts.

20. Procedure and device according to one or more of the prior claims, characterized in that the data transmission between the device and the information carrier is at least partially contactless, e.g. with inductive, capacitive or optoelectronic means.

21. Procedure and device according to one or more of the prior claims, characterized in that the power supply is from solar cells and/or batteries or chargeable batteries.

22. Procedure and device according to one or more of the prior claims, characterized in that the information carrier can be inserted in a receiving slot in the device.

23. Procedure and device according to one or more of the prior claims, characterized in that there is a receptacle on the back of the device for the information carrier.

24. Procedure and device according to claim 23, characterized in that the receptacle on the back of the device is secured by a swing-open cover.

25. Procedure and device according to one or more of the prior claims, characterized in that after the cover is closed, elastic contacts are tensioned that secure the electrical connection between the device and the information carrier.

26. Procedure and device according to one or more of the prior claims, characterized in that a changeover switch is on the device which switches the data input from digital to analog signals or vice versa.

27. Procedure and device according to claim 26, characterized in that the changeover switch has an automatic recognition circuit that recognizes whether digital or analog information is entered and accordingly switches the input.

28. Procedure and device according to one or more of the prior claims, characterized in that a plug device is provided to connect the device with a computer and/or other devices such as scanners, printers, modems. etc. /6

Attached: 2 pages of drawings

Empty Page

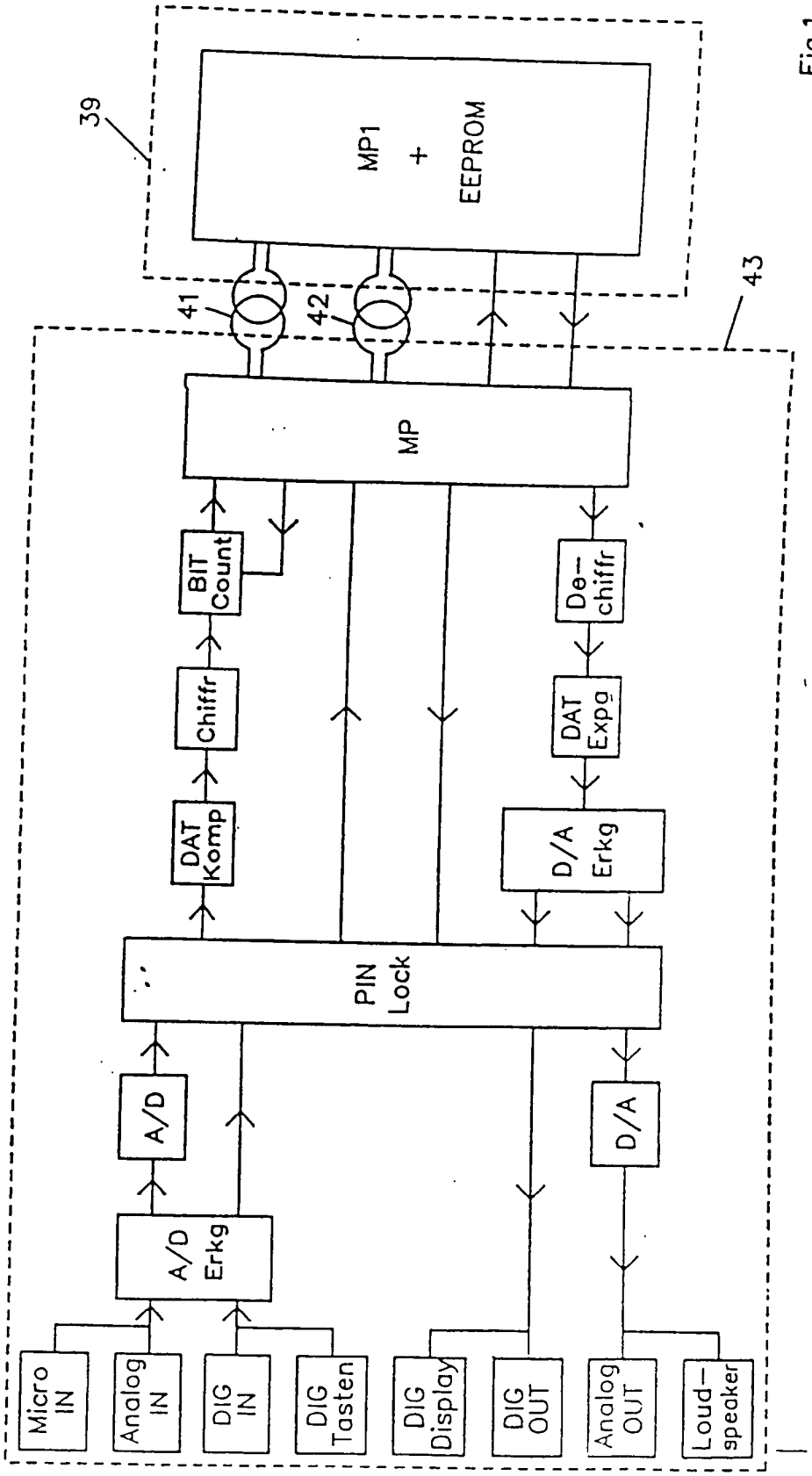

39
MP1
+
EEPROM
41
42
43
MP
BIT Count
Chiffr
DAT Komp
De-chiffr
DAT Expg
D/A Erkg
PIN Lock
A/D
A/D Erkg
D/A
Micro IN
Analog IN
DIG IN
DIG Tasten
DIG Display
DIG OUT
Analog OUT
Loud-speaker

Fig.1

Key to Fig. 1
Tasten - keys
Erkg - recognition
Komp - compression
Chiffr - encode
Dechiffr - decode

Fig.2

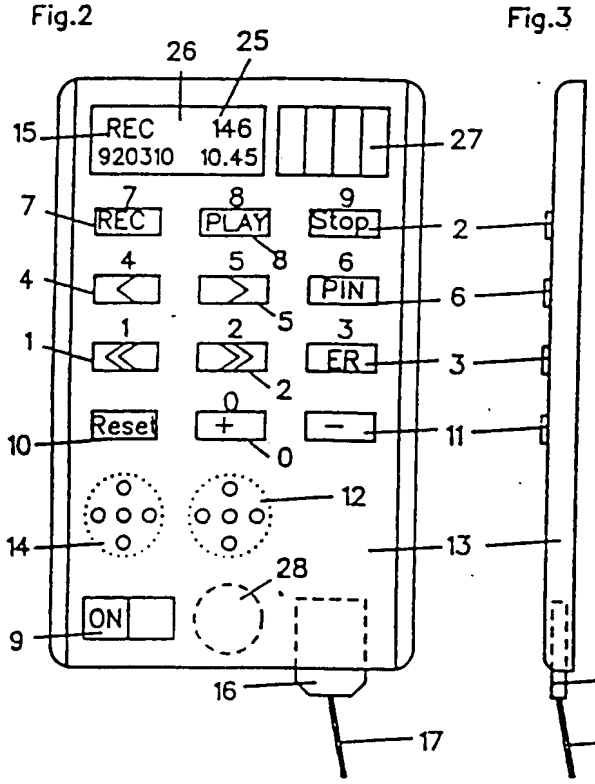


Fig.3

Fig.4

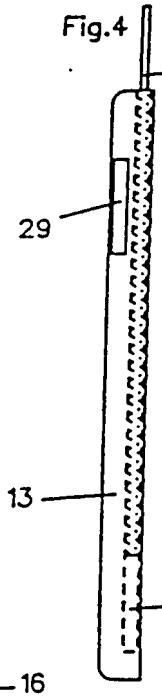
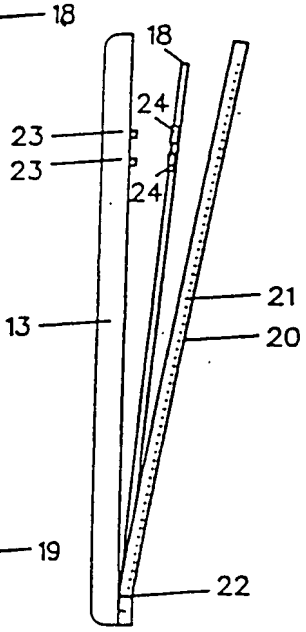


Fig.5



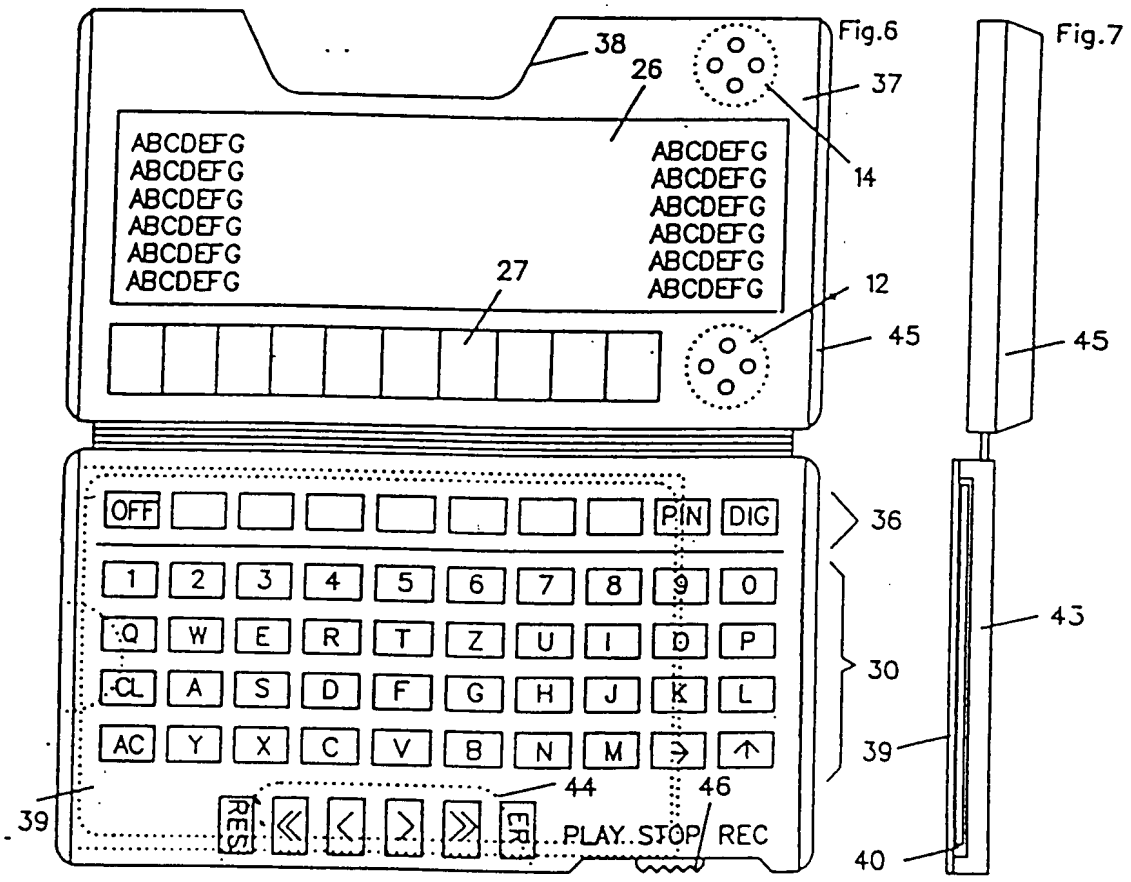


Fig.6
Fig.7
38
26
37
14
ABCDEFG
27
12
45
45
OFF
PIN
DIG
36
1 2 3 4 5 6 7 8 9 0
Q W E R T Z U I O P
CL A S D F G H J K L
AC Y X C V B N M
30
43
39
39
44
46
RES
ER
PLAY
STOP
REC
40